B3 Systems, Inc.
Environmental and Automation Solutions

April 7, 2015

Robert W. Baxter's Reply to Comments from:

Cooper Environmental Services, LLC

On

Air Pollution Control Title V Permit #V-IL-1716300103-2014-10 (Draft) for

Veolia ES Technical Solutions, LLC

Docket EPA/RO5/OAR/2014-0280

I offered my comments in December, 2014 to Veolia's Draft Title V permit in the form of a letter to Veolia's counsel, Joseph M. Kellmeyer. My comments were submitted to Region 5's Docket:EPA-RO5-OAR-2014-0280 and are reflected on the website containing comments which is maintained by Region 5.

After the Docket was closed, Cooper Environmental Services (CES) responded to my comments. I am therefore replying to CES' response. I request that if Region 5 considers CES' untimely response that Region 5 also consider my reply to CES' response.

Reply to Comments

The following is a summary of my thoughts based on the items raised by CES in their comments and organized per each CES comment. I have included only the CES headings for which I have comments.

1. Traverse versus single point sampling

CES references a document and test results from a test for a Tapered Element Oscillating Microbalance (TEOMTM). This reference represents approximately two and one-half (2-1/2) hours of data at one facility and can not be taken as representative of all emission stacks. The TEOM study only used two (2) ports in the stack while the plant was operating at base load only and was not a complete characterization of the entire stack or changes in operational conditions. Even the report states that *"it can be concluded that stratification of particulate matter is not present, at least in the areas tested."* Importantly, CES does not and cannot allege that the entire stack was homogeneous and without stratification.

CES also referenced a second document regarding work performed by Jim Peeler and Laura Kinner, Emissions Monitoring, Incorporated ("EMI"). EMI subsequently submitted its own Response to CES comments. EMI attached a letter and stated in relevant part:

> [t]he attached letter to Cooper Environmental Services explains that their comments submitted to same Docket are misleading and erroneous. EMI requests that they remove references to our company name and research.

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Under pressure from EMI, CES subsequently submitted a revised response removing the references to EMI's company name and research.

2. Commentary that particle size issues cause an inability of the Xact to collect a representative sample.

CES is correct in that I did not present nor do I have any information on particle sizes from any of the Veolia units. I also agree that baghouses are very efficient at removing PM during different process conditions and particle sizes. However the reality of a baghouse is that bags fail from time to time and for various reasons. When a bag or bags fail, the particles that pass through the failure point are not limited by size or any other characteristic. These particles will include anything the gas stream can carry (metals, lime, etc).

Based on over 15 years of hands-on work with baghouses (monitoring, controls and diagnostics), lab-based research on filter media efficiencies does not represent the real-world. Veolia utilizes pulse-jet baghouses for the collection and removal of PM. Pulse-jet baghouses utilizes compressed air to create pulse in the reverse direction. This reverse pulse creates a "bubble" of air which travels down the length of the bag to flex the bag material and break up and remove the filter cake on the outside of the bag. The repeated flexing of the bag creates wear over time which results in failures. Since the efficiency of the baghouse is improved with a larger filter cake, the removal of the cake with the pulsing action creates the classic pulse-jet cleaning pattern, which creates increased PM during the cleaning process. Figure 6 from EPA's guidance on bag leak detectors 2 shows the peaks from a classic pulse-jet cleaning pattern. The "pulses" release a variety of particle sizes based on a number of factors, including but not limited to the material and condition of the bags.

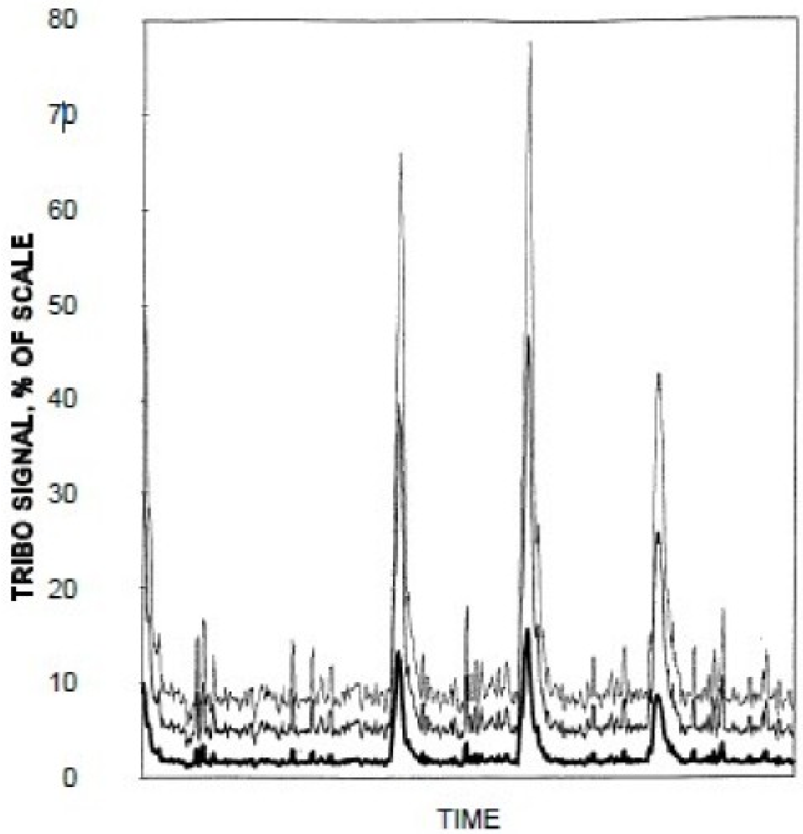

Figure 6 from EPA BLD Guidance

The research of particle transport is relatively new by engineering standards. Some of the earliest research was done in the 1960's and 1970's. As with all research, it was conducted in very controlled conditions and the smallest particles were spherical and approximately 20 microns in size. It is commonly stated by each researcher that the actual particle characteristics that affect particle transport are shape, material, particle size, velocity, transport medium density. Making this an extremely complex answer and one that can vary with changing process conditions.

While researching particle transport for another application, I discovered a masters thesis from Rutgers University by Suleyman Kemal Betin 1 on the transport of nano-particles (all submicron). The main focus of the thesis was to study the saltation velocity of nanometer particles during pneumatic conveying and comparing existing estimates of saltation velocity. Saltation velocity is the velocity at which particles particles of a homogeneous solid/gas flow will start to fall out of the gas stream during horizontal transport.

In this study it was found that the existing equations used to estimate saltation velocity were not accurate for nano-particles. The additional work to identify the differences in the estimates and actual experimental values is most important. It found that previous saltation estimates were based primarily on gravitational and inertial forces of particles. However many other forces affect particles in a gas stream. The gravitational force is not the dominant force for particles less than 3 microns in size. Thermal, electrostatic and Van Der Waals forces become more significant than gravitational forces on small particles.

Thermal force is the flow of thermal energy or temperature and can cause small particles to migrate from high temperature zones to lower temperature zones.

Electrostatic forces are the charges in a system that affect the attraction or repulsion of different particles and materials based on their electrical charge. Electrostatic charges can generated from particle interaction while flowing through the gas stream (e.g., triboelectric effect) or by outside electrical interaction such heating elements.

Van Der Waals forces are the forces between particles and includes attractions and repulsions between atoms, molecules, and surfaces, as well as other intermolecular forces

The study was based on nano-particles of carbon black and silica particles and concluded that the affects or total forces were different for different materials. Based on materials types and process conditions, the forces described above could cause very small particles to be attracted to the side wall of the stack / transport line or repelled away from the stack / transport line. The same forces could cause particles to agglomerate and effectively act like larger particles or repel each other.

In short, this is a complex situation in a dynamic process. It would be very, very difficult for a fixed single point sampling location to generate the same results as a traversing sampling train which has multiple sampling locations and also recovers the contents that are deposited in the sampling probe.

3. Concern over particulate matter buildup on transport walls

As previously stated, among the reasons the Xact cannot achieve Method 29 compliance is because the Xact uses a fixed single point sampling location. Given the high probability that particles are not extremely well distributed in the stack gases and the sample transport system, the Xact's single point sampling locations are unlikely to obtain a final representative sample. Having said this, CES also warns that Xact results may be biased if "[t]he large chuck [sic] of built-up PM on the transport wall would have to be extremely well distributed across the entire transport line to have the possibility of falsely impacting the Xact's filter and detector." Thus, the Xact is likely to produce erroneous results both when the PM is not well distributed due to being unable to obtain a representative sample *and* when the PM is well distributed due to chunks breaking from the transport wall and falsely impacting the Xact's filter and detector.

Again, stack gases and the sample transport system are both dynamic processes. The Xact cannot compare to Method 29 because it does not recover any buildup or deposits on walls in this continuous system and therefore the Xact cannot accurately report on the make-up of the stack gases.

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References

1. “Saltation of Pneumatically Conveyed Nanoparticles”, Suleyman Kemal Betin, Master of Science Thesis, Rutgers, The State University of New Jersey
2. “Fabric Filter Bag Leak Detection Guidance”, EPA-454/R-98-015, September 1997